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Name of the invention: ~~DUPLICATING DEVICE FOR STORED INFORMATION~~

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## Detailed Report

### 1. Name of the invention

#### DUPLICATING DEVICE FOR OPTICAL MEDIA

### 2. Sphere of the patent request

(requested claim 1)

This invention is regarding a duplicating device for information stored on optical media which consists of the following: a driver rotates an optical memory disk which has been recorded by methods such as forming pits on the recording layer using a collimated laser beam; a second driver rotates the medium which receives the stored information or a master disc at the same rotation speed as the medium which is rotated by the first driver; an optical head reads information from the media as it is rotated by the first driver; a controlling circuit which transforms the read signal from this optical head into a write signal and sends it to the write head; a head which writes information on the second medium or an original disc in accordance with the write signal from this control circuit.

### Detailed explanation of the invention

(technical field of the invention)

This invention is regarding a duplicating device for optical media which can reproduce information on one medium and write it on a medium for duplicating the stored information optically by methods such as forming pits on the recording layer by collimated laser beams.

Recently, optical disc memory has been widely used for recording and retrieving or retrieving only because it has many merits such as 100 times the bit density of magnetic media, it is capable of non-contact reading and writing, it is capable of high speed random access, it has excellent shelf life, it is an easy recording method, it is capable of addition recording, its cost per bit is inexpensive, etc. Applications for read-only media include video discs for home use, video discs for commercial use, audio PCM discs, etc. Applications for read/write media include document storage, storing video files, calculator memory, etc.

Along with the proliferation of this information processing device, there has been a demand for a device which can copy the information from one disc to another by methods such as forming pits on a recording layer by collimated laser beams.

Former methods of duplicating information from a memory medium include No. VSP-3832547, VSP-4107528, or Japan patent No. S 55-32250.

All these methods use an information recording layer with pits (holes) as a mask. In other words, light is transmitted by the pits in the information recording layer. A second media with a recording layer which has higher writing sensitivity than the original recording layer is placed next to the disc to be copied, and light is irradiated from the information recording layer with the pits in order to reproduce the information.

However, according to this method, there are problems such as the followings:

- (a) As is obvious, the laser beam is stopped down close to the diffraction limit, and pits are open to the recording layer. Accordingly, since light transmitted by the pit diverges rapidly, if pits with the same size as pits on the original recording layer are to

be produced on the recording layer of the copy, it is necessary to make the space between the original recorded layer and the recording layer of the copy as small as 2 to 3  $\mu\text{m}$  or less for duplicating, which has associated technical difficulties.

- (b) During duplication, it is impossible to irradiate the total surface all at once because of problems with recording sensitivity of the recording layer of the copy. Therefore, it is necessary to scan the total surface by a collimated laser beam, etc, which takes time.
- (c) Only one copy at a time can be produced. Additional copies must go through the entire copying process, so this method is not suitable.
- (d) In order to make the space between the recording layer on the original and the recording layer on the copy as small as 2 to 3  $\mu\text{m}$  or less and to enable laser scanning of the total surface, a very large device is necessary. Not only that, manufacturing cost per copy is high, and it cannot be reproduced easily by users.

This invention was made based on the above circumstances. Its object is to offer a device for duplicating stored information which can reproduce information easily by using a relatively simple and inexpensive device and which also can be used to make multiple copies easily.

In the following, one example of practice of this invention is going to be explained based on figures. Figure 1 shows a duplicating device. In the figure, 1 is the optical memory medium where information has been recorded by, for example, producing pits in the recording layer by using collimated laser beams. This information memory medium 1 has the following basic structure: two clear substrates 3, 3, with a recording layer 2 such as Te on one side are pasted together so the recording layers 2, 2 will be inside. A bonding layer or hollow center part exists between the facing surfaces of the recording layer 2, 2, and a hole (not shown in figure) is positioned in its center to allow for rotation.

In the figure, 4 is the medium which receives the information copied from medium 1; 4' is a master disc. This medium for duplicating stored information 4 has a recording layer 2 on one side of a substrate 5 which consists of glass; the master disc 4' has a light-sensitive photo resist layer 6. It is a disc shape which has a hole (not shown in figure) in its center to allow for rotation.

The memory medium 1 to be copied is rotated by the first medium driver 7, and the medium for duplicating the store information 4 or a master disc 4' is rotated by the second medium driver 8. These first and second medium drivers 7, 8 are identical. In other words, they both have a motor 9 and turntable 11 which are attached to a shaft 10 and a medium holding tool 12 which is joined to the rotating shaft 10. The information memory medium 1 or medium for duplicating stored information 4 or master disc 4' are placed on the turntable 11 so that center hole matches the rotation shaft 10. The medium holding tool 12 is joined to the rotating shaft 10, and the information memory medium 1 and medium for duplicating stored information 4 or master disc 4' are fixed so that they will not move.

A synchronizing signal is sent from the control circuit 15 to the drive circuit 13 which controls the motor 9 of the first medium driver 7 and the drive circuit 14 which controls the motor 9 of the second medium driver 8, and the information memory medium 1 and the medium for duplicating stored information 4 or master disc 4' are rotated at the same rate. Specifically, a rotary encoder (not shown in figure) is attached to each motor

9, 9 or turntable 11, 11, and each motor drive circuit 13, 14 is phase-locked by the control circuit 15 so that the signal output will always be in phase.

Near the first medium driver 7, there is an optical head 16 that reads information from the rotating information memory medium 1 using collimated light. Near the second medium driver 8, there is an optical head for writing information 17 onto the rotating medium for duplicating stored information 4 or master disk 4'. These optical heads 16, 17 are designed to be moved in the radial direction of the information memory medium 1 or medium for duplicating stored information 4 or master disk 4' by a mechanism which is not shown in the figure.

Furthermore, signals read by the optical read head 16 are output to the write head 17 after transforming it to a write signal by the control circuit 18. In other words, the optical head for reading information 16 reads information stored on the memory medium 1. Reading of this information works as follows: The difference in reflectivity caused by the pit in the recording layer 2 in the memory medium 1 is transformed to a voltage change by a photoelectric element inside the optical head for reading information 16, and the information is transferred as a time series to the information reading circuit 19. The information reading circuit 19 amplifies the time series and sends it to the writing circuit 20 (it is the same as the original signal without any modulation). The optical head for writing information 17 controls a laser beam 22 to transfer the information to the surface of the medium for duplicating stored information 4 or master disc 4'. This duplicating device 21 can use an external signal in addition to the signals generated by the optical head for reading information 16. The external signal may be connected directly to the writing circuit 20. This external signal may be generated by processing the signal from the reading circuit 19 from the optical head for reading information 16.

However, as shown in figure 2, when a copy 4 is to be made, information is reproduced as pits in the recording layer 2. When a master disc 4' is to be produced, as shown in figure 3(j1), a collimated laser beam 22 is directed to a master disc 4' which consists of a uniform photo resist layer 6 on the surface of a substrate 5 which consists of a flat glass plate. As shown in figure 3(j2), the laser beam 22 is collimated by a lens 23 in the optical head for writing information 17, and then information is exposed to light in a spiral shape. Next, the contents of memory medium 1 are reproduced as latent images on the photo sensitive layer 6. Next, the master disc 4' with the latent image is removed from the second medium driver 8. After that, developing and fixing are performed in a post-processing device which is not shown in the figures. As shown in figure 4, features 24 will be formed on the photo resist layer 6.

Next, as shown in figure 5, the features 24 on the master disc 4' are coated with a reflective layer 25 which consists of a thin metal film such as Al, Ni, or Cr by vacuum evaporation to a thickness of about 1000 Å, and a reproduction 1' of the memory medium 1 is formed.

When multiple reproductions are desired 1', instead of forming a reproduction 1' by forming a reflective layer 25 directly on the master disc 4', the process shown in figure 6 should be followed. A replica 28 of the master disc 4' is made from a master plate 26 which is made from the master disc 4'. A stamper 27 is made from this master plate 26. By forming a reflective layer 25 on this reproduced master disc 28, multiple reproductions 1' can be made effectively.

That is, as shown in figure 6 (j1), a metal layer 26' is formed by plating the master disc 4' on the information side 24 with a metal such as nickel, as shown in figure 6 (j2). The metal layer is shown as 29 in the figure. This metal layer 26' is released from the medium 4 as shown in figure 6 (j3), and it makes a master plate 26.

Furthermore, as shown in figure 6 (j4), another metal layer 30' is formed by metal plating 29 again on the information side of the master plate 26. After releasing this metal layer 30', a mother plate 30 is made. Next, as shown in figure 6 (j5), metal plating 29 is performed on the surface of the mother plate 30, and this metal layer 27' is released from the mother plate 30 as shown in figure 6 (j6) to make a stamper 27.

However, as shown in figure 6 (j7), after the surface of the stamper 27 is released, a layer 31 of monomer liquid 31' photo polymer flows in. Also, as shown in figure 6 (j8), a clear substrate 32 is placed on top of that. Next, by applying UV 33 through the clear substrate 32, the monomer liquid 31' is polymerized, and a photo hardening type resin layer 31 is formed.

Next, as shown in figure 6 (j9), the photo hardening type resin layer 31 and stamper 27 are separated, and a reproduction master disc 28 the same as the master disc 4' is made. Next, as shown in figure 6 (j10), a reflective layer 25 is formed on this reproduced master disc 28 to form a reproduction 1'.

However, in the case when many reproductions 1' are desired, the following steps can be taken. The process of flowing in of photo hardening monomer liquid 31' on the stamper 27, placing a clear substrate 32, application of UV 33, and separating the stamper and monomer layer as shown in figure 6 (j7, j8, j9) are repeated to form many reproduction master discs 28. Then by forming a reflective layer 25 on these reproduction master discs 28, many reproductions 1' can be made efficiently.

In the above example of practice, the master disc 28 has been reproduced by using a stamper 27 that is formed from a master plate 20. However, a master disc 28 can be reproduced by repeating the process shown in figure 6 (j7, j8, j9) on the master plate 26.

Although this example used an optical writing machine, it is acceptable to form a reproduction disc 1' by scratching a medium 4 such as a flat glass plate using a diamond needle using a mechanical writing head to make a spiral groove.

In addition, it is, of course, possible to change various details as long as the changes do not alter the main points of this invention.

As explained above, this invention can be used to copy information stored as features such as pits in a recording layer formed by a using a collimated laser beam, etc. The memory medium with the optical information is rotated, collimated light is applied, and the recorded information is read from the reflected light. These reading signals are transformed into writing signals, and the information is reproduced on a different medium or on a master disc. Compared to the former case which uses the recorded information layer as a mask, duplicating of information can be done easily using a relatively inexpensive device by a simple process. Not only that, all it requires is that the memory medium and medium for duplicating stored information or a master disc are mounted and a switch is pressed. This process can be done easily by anyone. Furthermore, it is possible to record information to a master disc as fine surface features. By making a master plate from this master disc and a stamper from this master plate, it is possible to make many reproductions inexpensively.

#### 4. simple explanation of figures

Figure 1 shows one example of practice of this duplicating device for stored information; figure 2 shows information being reproduced directly to a second medium by the device in this example of practice; figure 3 (j1, j2) indicate the process of forming a latent image on a master disc using the device in the example of practice; figure 4 shows reproduced information which consists of surface features on the master disc in the same example of practice; figure 5 explains the process of forming a reflective layer on the master disc shown in figure 4 to make a reproduction; figure 6 (jp1 to 10) explain the method of making a stamper from the master disc shown in figure 4 and then creating a reproduction using this stamper.

1: information memory medium, 1': reproduced plate, 4': master disc, 4: copy of medium for stored information, 7: the first medium driver, 8: the second medium driver, 16: optical head for reading information, 17: information writing head, 18: control circuit, 21: duplicating device for stored information

Assigned Representative: Takehiko Suzue, Patent Attorney

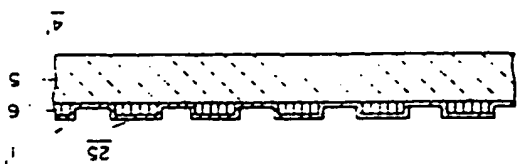


FIG. 5

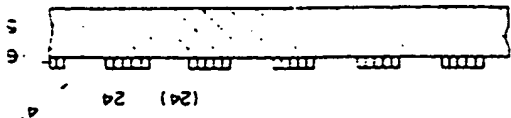
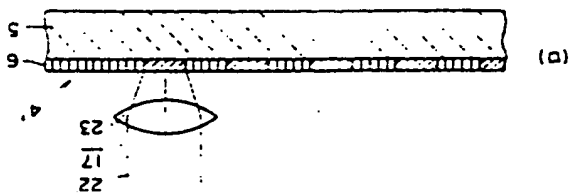
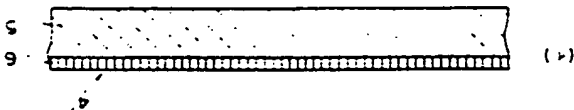


FIG. 4



(c)



(d)

FIG. 3

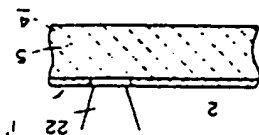


FIG. 2

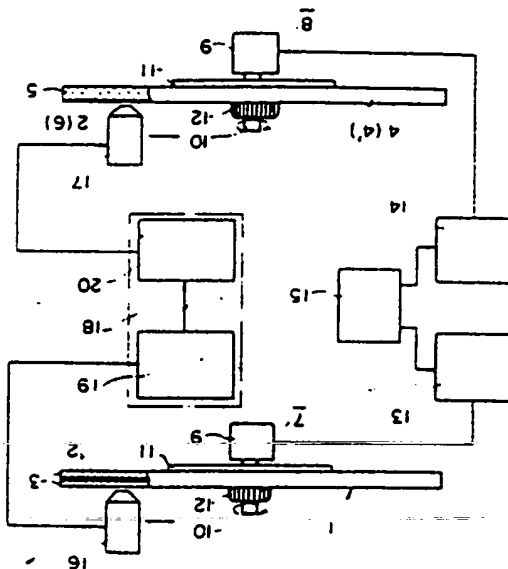
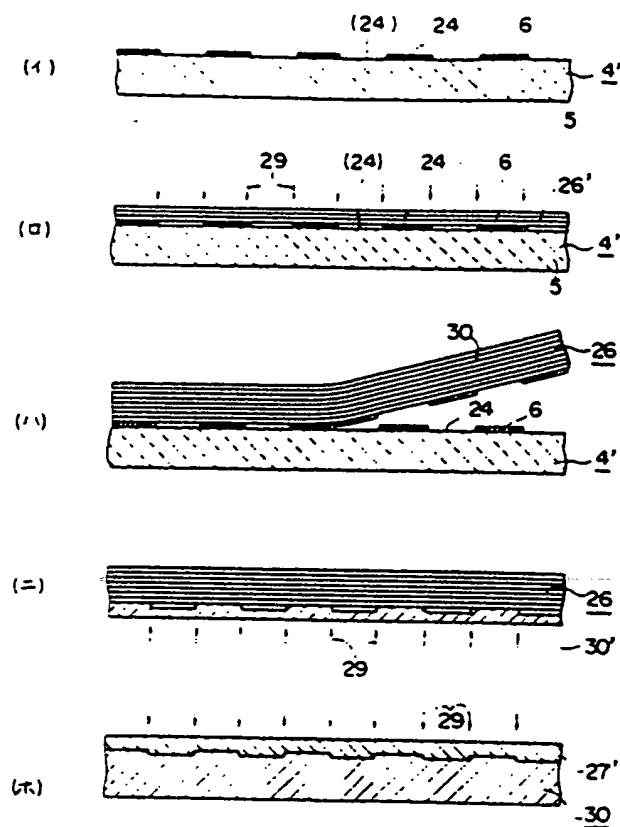
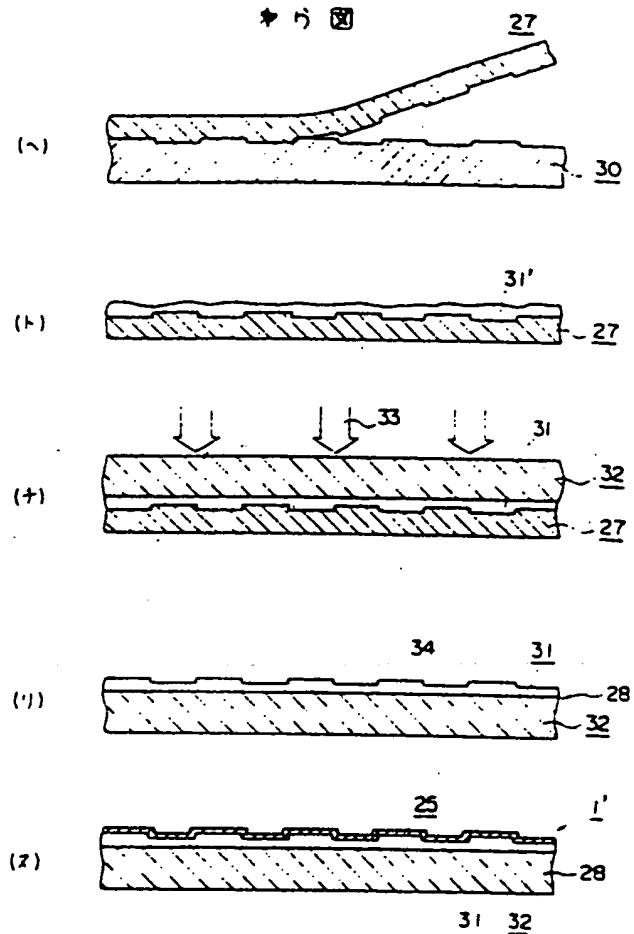


FIG. 1

★ 6 図



★ 7 図



配線情報複製用基体、もしくはその原盤とを単に取付けてスイッチ等を押すだけでよく、誰れでも簡単に複製できる。しかも原盤への情報記録を微細な表面凹凸形状で記録しておくことも可能となり、この原盤からマスター板さらにこのマスター板からスタンプを作ることにより、これらから多数の複製板を安価に作ることが可能となるといった効果を奏する。

#### 4. 図面の簡単な説明

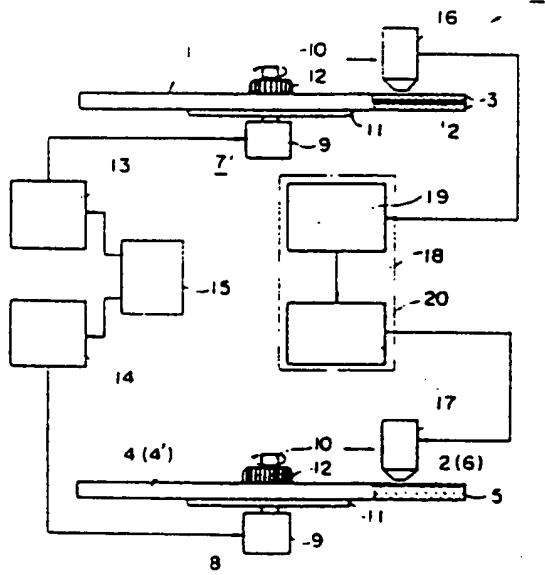
第1図は本発明の記憶情報複製装置の一実施例を示す概略的構成図、第2図は同実施例装置によって記録層を有した記憶情報複製用媒体に対して直接情報を複製する状態を示す説明図、第3図(イ)、(ロ)は同実施例装置による記憶情報複製用媒体の原盤への潜像形成動作を示す説明図、第4図は同実施例の原盤に対して表面凹凸形状からなる情報の複製した状態を示す説明図、第5図は第4図で示す原盤に光反射層を形成して複製板とした説明図、第6図(イ)~(ロ)は第4図で示す原盤からスタンプを作り、このスタンプを用

いて複製板を作成する方法を示す説明図である。

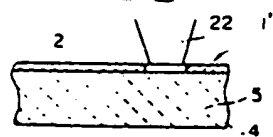
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出願人代理人 弁理士 鈴 江 武 彦

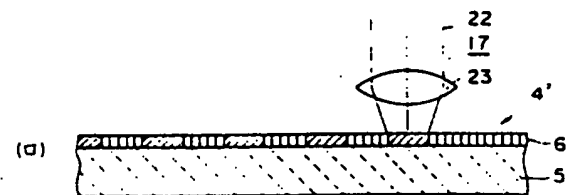
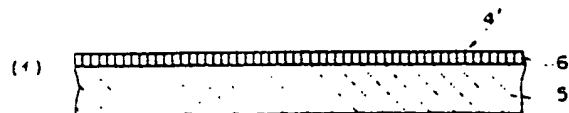
✱ i ☒



★ 2 國



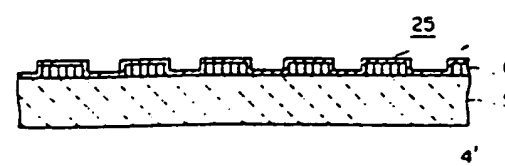
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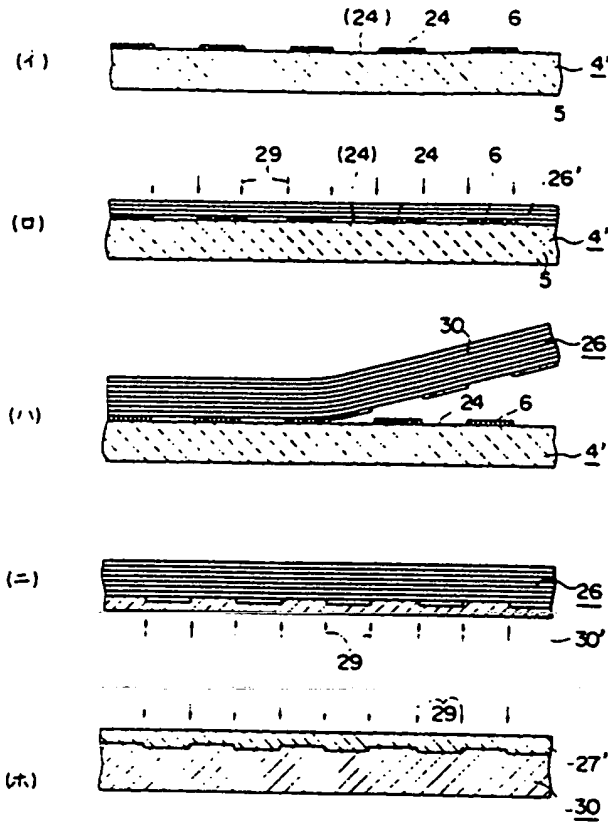
● ↓ 図



第五圖



第 6 図



第 7 図

